REMARKS/ARGUMENTS

Introduction:

No claims are amended, added, or newly canceled. Claims 26, 33, 35, 36, 41, 42, 48, 73-85, 87, 89-92, 94, 97-99, and 103-110 remain pending in the application. Applicants respectfully request reconsideration of the application.

Double Patenting:

Claims 26, 33, 35, 41, 42, 48, 73-85, 87, 89-92, 94, 97-99, and 103-110 were rejected on the grounds of non-statutory obvious-type double patenting over claims 1-23 of US Patent No. 6,672,875 to Mathieu et al. ("Mathieu") in view of US Patent No. 5,236,789 to Cowie et al.. ("Cowie") and German Patent No. 2,753,654 to Biberbach et al. ("Biberbach"). GB Patent No. 2,013,717 appears to be an English language equivalent of Biberbach. The PTO assets that Cowie and Biberbach render obvious the use of palladium cobalt as a tip material in the claims of Mathieu. As discussed below with regard to the rejections in view of prior art, Applicants assert that neither Cowie nor Biberbach would lead a person of ordinary skill to use palladium cobalt as the tip material of a microelectronic contact structure. At least for this reason, Applicants traverse this double patenting rejection and request that the rejection be withdrawn.

Obviousness:

Claims 26-33, 35, 41, 42, 48, 73-85, 87, 89-92, 94, 97-99, and 103-110 were rejected as obvious in view of US Patent No. 5,810,609 to Faraci et al. ("Faraci") or US 5,632,631 to Fjelstad et al. ("Fjelstad") as the primary reference and one or more of Fjelstad, US Patent No. 5,236,789 to Cowie et al. ("Cowie"), Biberbach, US Patent No. 3,648,366 to Shida et al. ("Shida"), US Patent No. 5,513,430 to Yanof et al. ("Yanof"), US Patent No. to Feussner ("Feussner"), Applicants respectfully traverse these rejections.

The PTO stated that Fjelstad discloses a test probe card 300 with probe contacts 302 but acknowledged that the tips 314, 324 of the probe contacts 302 are not made of palladium cobalt. The PTO likewise stated that Faraci discloses a probe card 110 but acknowledged that the tips 320 of the contacts of the probe card 110 are not made of palladium cobalt. To make up for this acknowledged deficiency in Fjelstad and Faraci, the PTO first cites Yanof for its teachings that tip 35 (see Figure 3 of Yanof) can be palladium. The PTO, however, acknowledged that Yanof

does not disclose the use of palladium cobalt as a material for the tip 35. The PTO thus acknowledged that Yanof is also deficient. To make up for this deficiency in Yanof, the PTO relies on Cowie, Biberbach, Shida, or Fuessner each of which the PTO asserts discloses use of palladium cobalt as an electrical contact material. The PTO asserts that it would have been obvious to modify Fjelstad, Faraci, and/or Yanof by replacing the tips of probes or contacts in those three references with palladium cobalt tips to increase the conductivity or wear resistance of the tips of Fjelstad, Faraci, and/or Yanof. Applicants respectfully traverse these rejections for t least the following reasons.

First, prior to Applicants' invention, there was not a reasonable expectation of success in using the specific alloy palladium cobalt as a contact tip material of microelectronic spring probes used to contact repeatedly the tiny, delicate terminals of semiconductor dies. As set forth in the Declaration of Dr. Rodney Martens (a copy of which is resubmitted with this Paper), there were a number of problems with both cobalt and palladium that would lead a person of ordinary skill to believe that palladium cobalt would not work as a contact tip for probes used to contact repeatedly the tiny, delicate terminals of semiconductor dies. For example, material from the terminals of the dies had a tendency to stick to tips made of a cobalt alloy. (Martens declaration ¶ 6.) Also, the cobalt in tips made of a cobalt alloy had a tendency to migrate to the surface of the tip and form an undesirable oxide. (Martens declaration ¶ 7.) Palladium as a tip material is too soft and has a tendency to form undesirable frictional polymers when used to repeatedly contact the terminals of the dies. (Martens declaration ¶ 9; see also Cowie col. 1, line 53 ("Palladium is soft and prone to wear.").) The Martens declaration is thus strong evidence that a person of ordinary skill in the field would not have had a reasonable expectation of success that the specific alloy palladium cobalt would work as a contact tip for microelectronic probes like Faraci's and Fjelstad's used to repeatedly contact the tiny, delicate terminals of semiconductor dies.

Moreover, none of Cowie, Biberbach, Shida, or Fuessner refutes the foregoing because the disclosed use of palladium cobalt in each of Cowie, Biberbach, Shida, or Fuessner is completely different and has nothing to do with contacting the tiny, delicate terminals of semiconductor dies. Indeed, none of Cowie, Biberbach, Shida, or Fuessner discloses use of palladium cobalt as a tip material of a microelectronic probe sized and configured to contact the tiny, delicate terminals of semiconductor dies. Cowie, for example, utilizes palladium cobalt as

part of presumably relatively large electrical structures in the engine of an automobile (Cowie col. 1, line 25.). Bibenbach utilizes palladium cobalt in applicants designed for "heavy mechanical loads" (see the English translation of the abstract of DE 2,753,654) that are "subjected to serve [sic: severe?] mechanical stresses" (see page 1, line 16 of GB 2,013,717). Cowie's and Bibenbach's disclosures are thus clearly not applicable to microelectronic probes for repeatedly contacting the tiny, delicate terminals of semiconductor dies.

Feussner and Shida likewise fail to provide any teachings that are applicable to such microelectronic probes. Indeed, as discussed in previous papers submitted by Applicants, Shida merely discloses a three-layer sheet (see Figure 1 of Shida), which is not equivalent to nor can it be substituted for small protrusions like Fjelstad's asperities 314 and caps 324 (which the PTO equated with the tips in the claims of the instant application) or Faraci's small asperities 320 (which the PTO equated with the tips in the claims of the instant application).

Because both Faraci and Fjelstad disclose microelectronic probes sized and configured to contact repeatedly the tiny, delicate terminals of semiconductor dies but none of Cowie, Biberbach, Shida, or Feussner disclose use of palladium cobalt in any application other than relatively larger contact structures, none of the teachings of Cowie, Biberbach, Shida, or Feussner would provide a person of ordinary skill in the field with a reasonable expectation of success in using palladium cobalt in the tips of Faraci's or Fjelstad's probes. For at least this reason, the rejections should be withdrawn.

Second, as discussed in Applicants' most recent Paper, the use of palladium cobalt in tips of microelectronic probes sized and configured to contact repeatedly the tiny, delicate terminals of semiconductor dies provides unexpected results. As set forth in Dr. Martens' declaration, the performance and characteristics of any material used as a contact tip for probes making hundreds of thousands of contacts with terminals of semiconductor dies cannot be predicted in advance. (Martens declaration ¶ 5.) In fact, FormFactor scientists and engineers initially thought other materials (e.g., nickel cobalt and gold cobalt alloys) might exhibit the desired hardness and electrical conductivity characteristics. (Martens declaration ¶¶ 7-10.) Moreover, as discussed above, there were reasons to believe neither palladium nor cobalt would make a suitable contact tip material for probes designed to contact terminals of semiconductor dies hundreds of thousands of times. Nevertheless, after repeated experiments with several different materials and against all expectations, the inventors discovered that palladium cobalt provided and maintained

over hundreds of thousands of contacts with terminals of semiconductor dies the desired wear and conductivity characteristics. Importantly, the palladium cobalt did so without appreciable material from the terminals adhering to the palladium cobalt, and the palladium cobalt did not form undesirable frictional polymers or oxide layers. (Martens declaration ¶ 11.)

For at least the foregoing reasons, Applicants respectfully assert that palladium cobalt—as a contact material for probes of a probe card—provides unexpected results throughout the life time of a probe card, which includes hundreds of thousands of contacts with bond pads of semiconductor dies.

Conclusion:

In view of the foregoing, Applicants submit that all of the claims are allowable and the application is in condition for allowance. If the Examiner believes that a discussion with Applicants' attorney would be helpful, the Examiner is invited to contact the undersigned at (801) 426-2106.

Respectfully submitted,

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By /N. Kenneth Burraston/
N. Kenneth Burraston
Reg. No. 39,923

Kirton & McConkie
P.O. Box 45120
Salt Lake City, Utah 84145-0120
Telephone: (801) 426-2106
Fax: (801) 321-4893